AMENDMENTS TO THE CLAIMS

Please amend Claims 1, 3-8, 10 and 11; and add new Claims 12-16 as follows.

LISTING OF CLAIMS

1. (currently amended) A vehicle air conditioning system comprising:

an air duct for blowing conditioned air into a passenger compartment;

a refrigeration cycle having:

a cooling heat exchanger disposed within said air duct to serve as a heat absorber in a dehumidifying mode;

a heating heat exchanger disposed downstream of said cooling heat exchanger, in a direction of airflow within said air duct, to serve as a heat radiator in the dehumidifying mode;

an external heat exchanger disposed external to said air duct to serve as a heat absorber or a heat radiator in the dehumidifying mode;

a first variable throttle valve connected between said heating heat exchanger and said external heat exchanger, wherein said first variable throttle valve is capable of decompressing a refrigerant introduced from said heating heat exchanger as well as changing the degree of valve opening thereof;

a second variable throttle valve connected between said external heat exchanger and said cooling heat exchanger, wherein said second variable throttle valve is capable of decompressing the refrigerant introduced from said external heat exchanger as well as changing the degree of valve opening thereof; and

a dehumidifying mode circulation path for circulating refrigerant discharged from a refrigerant compressor along a path from said heating heat

exchanger through said first variable throttle valve, said external heat exchanger, said second variable throttle valve, and said cooling heat exchanger to said refrigerant compressor;

[[a]] cycle efficiency sensing means for sensing a current cycle efficiency;

[[a]] cycle efficiency determination means for calculating a target cycle efficiency; [[and]]

[[a]] first throttle valve control means for controlling the degree of opening of ~~any one of~~ said first variable throttle valve ~~and said second variable throttle valve~~ in the dehumidifying mode in accordance with a deviation between said target cycle efficiency set by said cycle efficiency determination means and said current cycle efficiency sensed by said cycle efficiency sensing means[[.]];and

second throttle valve control means for controlling the degree of opening of said second variable throttle valve in the dehumidifying mode in accordance with one of a dehumidifying capacity of said cooling heat exchanger and a heating capacity of said heating heat exchanger.

2. (original) The vehicle air conditioning system according to claim 1, wherein

said refrigerant compressor is a motor-driven refrigerant compressor rotatably driven by a drive motor that is controllably activated by an inverter serving as a drive power supply.

3. (currently amended) The vehicle air conditioning system according to claim 2, wherein

said cycle efficiency sensing means is a high-pressure sensing means for sensing a high pressure in said refrigeration cycle,

said cycle efficiency determination means is a first high-pressure determination means, having a first refrigerant temperature sensing means for sensing a temperature of the refrigerant at an outlet of said heating heat exchanger, for calculating a target high pressure providing a maximum cycle efficiency in accordance with the temperature of the refrigerant sensed by said first refrigerant temperature sensing means at the outlet of said heating heat exchanger, and

in accordance with a pressure deviation between a current high pressure sensed by said high-pressure sensing means and the target high pressure set by said first high-pressure determination means~~, said throttle valve control means controls the degree of opening of any one of said first variable throttle valve and said second variable throttle valve~~.

4. (currently amended) The vehicle air conditioning system according to claim 2, further comprising:

[[a]] capacity overload sensing means for sensing a capacity overload on said heating heat exchanger~~, wherein~~ ;and

said cycle efficiency sensing means is high pressure sensing means for sensing a high pressure in said refrigeration cycle, wherein

said cycle efficiency determination means is ~~a second~~ high-pressure determination means, having ~~a second~~ refrigerant temperature sensing means for sensing a temperature of the refrigerant at an outlet of said external heat exchanger, for calculating a target high pressure providing a maximum cycle efficiency in accordance with the temperature of the refrigerant sensed by said ~~second~~ refrigerant temperature sensing means at the outlet of said external heat exchanger, and

when a capacity overload on said heating heat exchanger is sensed by said capacity overload sensing means, and said first throttle valve control means controls the degree of opening of ~~any one of~~ said first variable throttle valve ~~and said second variable throttle valve~~ in accordance with a pressure deviation between a current high pressure sensed by said high-pressure sensing means and the target high pressure set by said ~~second~~ high-pressure determination means.

5. (currently amended) The vehicle air conditioning system according to claim 4, wherein

said capacity overload sensing means further comprises:

[[a]] heating capacity sensing means for sensing a heating capacity of said heating heat exchanger, [[a]] heating capacity determination means for calculating a target heating capacity of said heating heat exchanger, and [[a]] rotational speed sensing means for sensing a rotational speed of said refrigerant compressor, and

said capacity overload sensing means determines that said heating heat exchanger is overloaded when a deviation between the ~~current~~ heating capacity sensed by said heating capacity sensing means and the target heating capacity set by said

heating capacity determination means is greater than or equal to a certain value, and when a dehumidifying operation condition is satisfied in which the rotational speed of said refrigerant compressor sensed by said rotational speed sensing means is greater than or equal to a certain value.

6. (currently amended) The vehicle air conditioning system according to claim 2, further comprising:

[[a]] blowing temperature determination means for calculating a target blowing temperature of conditioned air blown into the passenger compartment,

a dehumidifying or defogging switch for requesting dehumidification of a passenger compartment or defogging of a glass window in an ON state, and

dehumidifying mode selection means for selecting a dehumidifying mode as an operation mode of said refrigeration cycle when the target blowing temperature set by said blowing temperature determination means is within a predetermined range or when said dehumidifying or defogging switch is in an ON state.

7. (currently amended) The vehicle air conditioning system according to claim 6, wherein

said dehumidifying mode selection means is [[a]] dehumidifying mode setting means for requesting either a dehumidifying mode of a dehumidifying priority mode or a blowing temperature priority mode, said vehicle air conditioning system further comprising:

[[a]] dehumidifying capacity sensing means for sensing a dehumidifying capacity of said cooling heat exchanger,

[[a]] dehumidifying capacity determination means for calculating a target dehumidifying capacity of said cooling heat exchanger,

[[a]] heating capacity sensing means for sensing a heating capacity of said heating heat exchanger,

[[a]] heating capacity determination means for calculating a target heating capacity of said heating heat exchanger, and

[[an]] air conditioning control means for controlling a rotational speed of said refrigerant compressor in accordance with a deviation between a ~~current~~ dehumidifying capacity sensed by said dehumidifying capacity sensing means and the target dehumidifying capacity set by said dehumidifying capacity determination means when the dehumidifying priority mode is requested by said dehumidifying mode setting means as well as for controlling the degree of opening of ~~any other of said first variable throttle valve and~~ said second variable throttle valve in accordance with a deviation between a ~~current~~ heating capacity sensed by said heating capacity sensing means and the target heating capacity set by said heating capacity determination means.

8. (currently amended) The vehicle air conditioning system according to claim 6, wherein

said dehumidifying mode selection means is [[a]] dehumidifying mode setting means for requesting either a dehumidifying mode of the dehumidifying priority

mode or the blowing temperature priority mode, said vehicle air conditioning system further comprising:

[[a]] dehumidifying capacity sensing means for sensing a dehumidifying capacity of said cooling heat exchanger;

[[a]] dehumidifying capacity determination means for calculating a target dehumidifying capacity of said cooling heat exchanger;

[[a]] heating capacity sensing means for sensing a heating capacity of said heating heat exchanger;

[[a]] heating capacity determination means for calculating a target heating capacity of said heating heat exchanger; and

[[an]] air conditioning control means for controlling a rotational speed of said refrigerant compressor in accordance with a deviation between a ~~current~~ heating capacity sensed by said heating capacity sensing means and the target heating capacity set by said heating capacity determination means when the blowing temperature priority mode is requested by said dehumidifying mode setting means as well as for controlling the degree of opening of ~~any other of said first variable throttle valve and~~ said second variable throttle valve in accordance with a deviation between a ~~current~~ dehumidifying capacity sensed by said dehumidifying capacity sensing means and the target dehumidifying capacity set by said dehumidifying capacity determination means.

9. (original) The vehicle air conditioning system according to claim 7, further comprising:

a dehumidifying or defogging switch for requesting dehumidification of a passenger compartment or defogging of a glass window in an ON state, and an air conditioner switch for activating said refrigerant compressor in an ON state or when either mode of operation, a cooling mode or a dehumidifying mode, of modes of operation of said refrigeration cycle is requested in an ON state, and

said dehumidifying mode setting means selects said dehumidifying priority mode to provide a higher priority to said dehumidifying priority mode than to said blowing temperature priority mode when said air conditioner switch is in an ON state or when said dehumidifying or defogging switch is in an ON state, or

said dehumidifying mode setting means selects said blowing temperature priority mode to provide a higher priority to said blowing temperature priority mode than to said dehumidifying priority mode when said dehumidifying or defogging switch is in an OFF state and when said air conditioner switch is in an OFF state.

10. (currently amended) The vehicle air conditioning system according to claim 7, further comprising:

[[a]] blowing temperature determination means for calculating a target blowing temperature of conditioned air blown into the passenger compartment, and [[an]] operation mode setting means for determining an operation mode of said refrigeration cycle in accordance with the target blowing temperature set by said blowing temperature determination means, wherein

said dehumidifying mode setting means selects said blowing temperature priority mode to provide a higher priority to said blowing temperature priority mode than

to said dehumidifying priority mode when said operation mode setting means changes the operation mode of said refrigeration from a heating mode to a dehumidifying mode.

11. (currently amended) The vehicle air conditioning system according to claim 1, wherein

said refrigeration cycle employs carbon dioxide as the refrigerant,

a supercritical vapor compressive heat pump cycle is employed in which the refrigerant is discharged from said refrigerant compressor at a pressure greater than or equal to a critical pressure of the refrigerant~~, and~~.

~~either one of said first variable throttle valve and said second variable throttle valve is said first variable throttle valve.~~

12. (New) A vehicle air conditioning system comprising:

an air duct for blowing conditioned air into a passenger compartment;

a refrigeration cycle having:

a cooling heat exchanger disposed within said air duct to serve as a heat absorber in a dehumidifying mode;

a heating heat exchanger disposed downstream of said cooling heat exchanger, in a direction of airflow within said air duct, to serve as a heat radiator in the dehumidifying mode;

an external heat exchanger disposed external to said air duct to serve as a heat absorber or a heat radiator in the dehumidifying mode;

a first variable throttle valve connected between said heating heat exchanger and said external heat exchanger, wherein said first variable throttle valve is capable of decompressing a refrigerant introduced from said heating heat exchanger as well as changing the degree of valve opening thereof;

a second variable throttle valve connected between said external heat exchanger and said cooling heat exchanger, wherein said second variable throttle valve is capable of decompressing the refrigerant introduced from said external heat exchanger as well as changing the degree of valve opening thereof; and

a dehumidifying mode circulation path for circulating refrigerant discharged from a refrigerant compressor along a path from said heating heat exchanger through said first variable throttle valve, said external heat exchanger, said second variable throttle valve, and said cooling heat exchanger to said refrigerant compressor;

cycle efficiency sensing means for sensing a current cycle efficiency;

cycle efficiency determination means for calculating a target cycle efficiency;

throttle valve control means for controlling the degree of opening of any one of said first variable throttle valve and said second variable throttle valve in the dehumidifying mode in accordance with a deviation between said target cycle efficiency set by said cycle efficiency determination means and said current cycle efficiency sensed by said cycle efficiency sensing means;

capacity overload sensing means for sensing a capacity overload on said heating heat exchanger, wherein

said refrigerant compressor is a motor-driven refrigerant compressor rotatably driven by a drive motor that is controllably activated by an inverter serving as a drive power supply,

said cycle efficiency sensing means is high-pressure sensing means for sensing a high pressure in said refrigeration cycle,

said cycle efficiency determination means is high-pressure determination means, having refrigerant temperature sensing means for sensing a temperature of the refrigerant at an outlet of said external heat exchanger, for calculating a target high pressure providing a maximum cycle efficiency in accordance with the temperature of the refrigerant sensed by said refrigerant temperature sensing means at the outlet of said external heat exchanger, and

when a capacity overload on said heating heat exchanger is sensed by said capacity overload sensing means, said throttle valve control means controls the degree of opening of any one of said first variable throttle valve and said second variable throttle valve in accordance with a pressure deviation between a current high pressure sensed by said high-pressure sensing means and the target high pressure set by said high-pressure determination means.

13. (New) The vehicle air conditioning system according to claim 12, wherein said capacity overload sensing means further comprises:

heating capacity sensing means for sensing a heating capacity of said heating heat exchanger,

heating capacity determination means for calculating a target heating capacity of said heating heat exchanger, and

rotational speed sensing means for sensing a rotational speed of said refrigerant compressor, and

said capacity overload sensing means determines that said heating heat exchanger is overloaded when a deviation between the heating capacity sensed by said heating capacity sensing means and the target heating capacity set by said heating capacity determination means is greater than or equal to a certain value, and when a dehumidifying operation condition is satisfied in which the rotational speed of said refrigerant compressor sensed by said rotational speed sensing means is greater than or equal to a certain value.

14. (New) A vehicle air conditioning system comprising:

an air duct for blowing conditioned air into a passenger compartment;

a refrigeration cycle having:

a cooling heat exchanger disposed within said air duct to serve as a heat absorber in a dehumidifying mode;

a heating heat exchanger disposed downstream of said cooling heat exchanger, in a direction of airflow within said air duct, to serve as a heat radiator in the dehumidifying mode;

an external heat exchanger disposed external to said air duct to serve as a heat absorber or a heat radiator in the dehumidifying mode;

a first variable throttle valve connected between said heating heat exchanger and said external heat exchanger, wherein said first variable throttle valve is capable of decompressing a refrigerant introduced from said heating heat exchanger as well as changing the degree of valve opening thereof;

a second variable throttle valve connected between said external heat exchanger and said cooling heat exchanger, wherein said second variable throttle valve is capable of decompressing the refrigerant introduced from said external heat exchanger as well as changing the degree of valve opening thereof; and

a dehumidifying mode circulation path for circulating refrigerant discharged from a refrigerant compressor along a path from said heating heat exchanger through said first variable throttle valve, said external heat exchanger, said second variable throttle valve, and said cooling heat exchanger to said refrigerant compressor;

cycle efficiency sensing means for sensing a current cycle efficiency;

cycle efficiency determination means for calculating a target cycle efficiency;

throttle valve control means for controlling the degree of opening of any one of said first variable throttle valve and said second variable throttle valve in the dehumidifying mode in accordance with a deviation between said target cycle efficiency set by said cycle efficiency determination means and said current cycle efficiency sensed by said cycle efficiency sensing means;

blowing temperature determination means for calculating a target blowing temperature of conditioned air blown into the passenger compartment;

a dehumidifying or defogging switch for requesting dehumidification of a passenger compartment or defogging of a glass window in an ON state; and

dehumidifying mode selection means for selecting a dehumidifying mode as an operation mode of said refrigeration cycle when the target blowing temperature set by said blowing temperature determination means is within a predetermined range or when said dehumidifying or defogging switch is in an ON state, wherein

said refrigerant compressor is a motor-driven refrigerant compressor rotatably driven by a drive motor that is controllably activated by an inverter serving as a drive power supply,

said dehumidifying mode selection means is dehumidifying mode setting means for requesting either a dehumidifying mode of a dehumidifying priority mode or a blowing temperature priority mode, and

said vehicle air conditioning system further comprises:

dehumidifying capacity sensing means for sensing a dehumidifying capacity of said cooling heat exchanger,

dehumidifying capacity determination means for calculating a target dehumidifying capacity of said cooling heat exchanger,

heating capacity sensing means for sensing a heating capacity of said heating heat exchanger,

heating capacity determination means for calculating a target heating capacity of said heating heat exchanger, and

air conditioning control means for controlling a rotational speed of said refrigerant compressor in accordance with a deviation between a dehumidifying

capacity sensed by said dehumidifying capacity sensing means and the target dehumidifying capacity set by said dehumidifying capacity determination means when the dehumidifying priority mode is requested by said dehumidifying mode setting means as well as for controlling the degree of opening of any other of said first variable throttle valve and said second variable throttle valve in accordance with a deviation between a heating capacity sensed by said heating capacity sensing means and the target heating capacity set by said heating capacity determination means, or for controlling a rotational speed of said refrigerant compressor in accordance with a deviation between a heating capacity sensed by said heating capacity sensing means and the target heating capacity set by said heating capacity determination means when the blowing temperature priority mode is requested by said dehumidifying mode setting means as well as for controlling the degree of opening of any other of said first variable throttle valve and said second variable throttle valve in accordance with a deviation between a dehumidifying capacity sensed by said dehumidifying capacity sensing means and the target dehumidifying capacity set by said dehumidifying capacity determination means.

15. (New) The vehicle air conditioning system according to claim 14, further comprising:

a dehumidifying or defogging switch for requesting dehumidification of a passenger compartment or defogging of a glass window in an ON state, and

an air conditioner switch for activating said refrigerant compressor in an ON state or when either mode of operation, a cooling mode or a dehumidifying mode, of modes of operation of said refrigeration cycle is requested in an ON state, and said

dehumidifying mode setting means selects said dehumidifying priority mode to provide a higher priority to said dehumidifying priority mode than to said blowing temperature priority mode when said air conditioner switch is in an ON state or when said dehumidifying or defogging switch is in an ON state, or said dehumidifying mode setting means selects said blowing temperature priority mode to provide a higher priority to said blowing temperature priority mode than to said dehumidifying priority mode when said dehumidifying or defogging switch is in an OFF state and when said air conditioner switch is in an OFF state.

16. (New) The vehicle air conditioning system according to claim 14, further comprising:

blowing temperature determination means for calculating a target blowing temperature of conditioned air blown into the passenger compartment, and

operation mode setting means for determining an operation mode of said refrigeration cycle in accordance with the target blowing temperature set by said blowing temperature determination means, wherein

said dehumidifying mode setting means selects said blowing temperature priority mode to provide a higher priority to said blowing temperature priority mode than to said dehumidifying priority mode when said operation mode setting means changes the operation mode of said refrigeration cycle from a heating mode to a dehumidifying mode.